

**THE APPLICANTS PROVIDE ADDITIONAL COMMENTS IN RESPONSE TO THE JANUARY 28, 2003 COMMUNICATION THROUGHOUT THE APPLICATION IN BOLD TYPE.**

The Office Action is directed to the invention elected, namely the invention of the Office's Restriction Group II drawn to a cured prepolymer or elastomer. Claims 35-39 are rejected under 35 USC § 112, second paragraph, for indefiniteness because the Office does not find support for our claimed range of viscosity. On review of the Examples the applicants note a range of 550-50000 cps. Consequently, the applicants amend the claim to conform with scope of the disclosure. **The Office enquires as to whether the viscosity of the claim pertains to the prepolymer. The applicants confirm that the claim language is accurate, namely, the prepolymer has a residual NCO of about 11.5-13.5% weight/weight and "has a room-temperature viscosity of about 550-50000 cps."** The Office is correct in assuming the viscosity is not a parameter which is relevant to the cured urethane elastomer.

Moreover, the Office solicits support for the claimed viscosity range. While the applicants understand that the Office does not require support for each and every point in the viscosity range, the applicants are happy to point out the representative prepolymer viscosity examples disclosed throughout the Specification. It is submitted that this disclosure responds to the Office's first and fourth enquiry. For the convenience of the Office, the applicants list the numerous viscosity examples in table form as follows:

<u>PAGE</u>	<u>LINE NUMBER</u>	<u>RANGE</u>	<u>PAGE</u>	<u>LINE NUMBER</u>	<u>RANGE</u>
2	25	1200-26000	16	19	1280
2	33	3500-5000	17	27	26000
5	4	3500-5000	21	4	550
5	18	300-50000	21	33	550
6	17	3000-5000	22	25	550
7	20	300-50000	23	17	550
7	27	3500-5000	24	8	550
8	4	300-50000	24	34	550
8	10	3000-5000	25	30	550
10	4	1200-26000	26	24	550
10	6	3500-5000	27	21	3980
10	29	300-50000	28	16	50000
10	30	4000-5000	29	11	3100
12	9	1200-26000	30	9	26000
14	23	4100	31	7	2160

Claims 34-55 are rejected under 35 USC § 112, second paragraph, for indefiniteness because the Office is confused by the language which claims both uncured and cured prepolymers. The applicants can understand the Office's confusion and, with this Response and Amendment, seek to clarify the claiming. Specifically, the applicants have with this response and amendment, amended Claims 34-48 to claim a urethane elastomer which is the reaction product of a prepolymer (P). Support for this amendment may be found in the Specification and at the end of original Claim 1.

Within the same basis for rejection, and as in the parent application, the Office complains because the prepolymer is listed as both the starting material, and also as a component of the curative according to Claims 34 and 41. The applicants can understand the Office's confusion and, with this Response and Amendment, seek to clarify the unique characteristics of the invention. To begin with, broad Claim 34 is now amended to claim a urethane elastomer which is the reaction product of a prepolymer (P) in combination with a "room temperature liquid curative," which curative does include the prepolymer.

It is important to explain that the claimed curatives are unique in that they do, indeed, consist of various components including the room temperature liquid stable prepolymer. One skilled in the art understands that curatives are designed to be highly reactive, which reactivity results in the generation of heat during the curing process. The instant prepolymers are, however, curable at room temperature. Thus, the inventiveness of these claims resides in that the applicants have discovered that by the addition of a portion of the short-chain prepolymer to the curative, the reactivity of the curative is attenuated without the addition of any substances which would alter the composition of the cured prepolymer. By adding the prepolymer to the curative, the applicants have effectively reduced the number of active sites on the curative, thereby controlling the rate of reactivity and thereby formulating a liquid curative active at room-temperature.

Claims 34, 36, 37, 40, 41, 52, 53, and 54 are rejected for indefiniteness because, as the Office notes, there is no basis for the weight percent values, and because the weight percent values are undefined. With this Response and Amendment, the basis weight percent ranges are reinserted into this Divisional Application. Support for this insertion may be found in the Specification and in the parent claims. Similarly, applicants have amended the claims to define the weight ratio in relative amounts weight/weight, as in the parent. **The Office enquires as to whether the weight percents are based on the weight of the prepolymer. The applicants confirm that the claim language is accurate, namely, "the percentage weight/weight in the prepolymer (P)", underlining added. The Office also enquires as to whether the language "stoichiometric excess" in Claims 38, 39, 43, and 44 is based on the stoichiometric groups. The applicants confirm that the claim language is accurate, namely, "the prepolymer (P) is present in stoichiometric excess with respect to the curative." In other words, the language may be interpreted literally that the a stoichiometric excess of prepolymer (P), based on the isocyanate groups, is provided with respect to**

**the number of hydroxyl groups of the curative. It is submitted that this interpretation would be that of one skilled in the art.**

The only remaining indefiniteness rejection pertains to the "liquid" state of the curative. The Office observes that the applicants have not disclosed how/why the curative of these claims are liquid. On review, the applicants note that the curing process is described to occur at room temperature with a liquid curative. Thus, the applicants believe that they have defined the curative to be liquid at "room temperature". Room temperature stable liquid curatives are not represented in the market; however, their performance characteristics are integral to the room-temperature curing of the claimed elastomers.

Finally, all claims are rejected under 35 USC § 112, first paragraph for lack of enablement. It is submitted that the definitional amendments made to the claims in response to the indefiniteness rejection has defined an invention which is enabled by the Specification.

**The Office notes that the last percentage value in Claims 41 and 53 is not within the range set forth in Claim 34. With this additional Response and Amendment, the applicants amend Claim 34 to provide sufficient range. Support for this amendment may be found in the Specification at page 6, line 15.**

\* \* \* \* \*

Accordingly, entry of the present amendment, reconsideration of all grounds of objection and rejection, withdrawal thereof, and passage of this application to issue are all hereby respectfully solicited.

It should be apparent that the undersigned attorney has made an earnest effort to place this application into condition for immediate allowance. If he can be of

assistance to the Examiner in the elimination of any possibly-outstanding insignificant impediment to an immediate allowance, the Examiner is respectfully invited to call him at his below-listed number for such purpose.

Allowance is solicited.

Respectfully submitted,

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Enclosure: Postal Card Receipt, and  
Amended Claims & Specification page in Clean & Marked-up forms.

**THE COMMISSIONER IS HEREBY AUTHORIZED TO CHARGE ANY FURTHER OR ADDITIONAL FEES WHICH MAY BE REQUIRED (DUE TO OMISSION, DEFICIENCY, OR DEFECT IN THE ATTACHED CHECK, OR OTHERWISE), OR TO CREDIT ANY OVERPAYMENT, TO DEPOSIT ACCOUNT NO. 08,3220.**

Amended Specification Page 1 (Marked Form)

LIQUID STABLE MDI PREPOLYMERS AND LIQUID STABLE  
CURATIVE SYSTEMS SUITABLE FOR ROOM TEMPERATURE CASTING WHICH  
YIELD HIGH PERFORMANCE URETHANE ELASTOMERS

5 The present application is a division of US Serial No. 09/593,913.

BACKGROUND OF THE INVENTION

Field of the Invention

Liquid stable MDI prepolymers and liquid stable curative systems suitable for room temperature casting which yield high performance urethane elastomers.

10 Prior Art

A search of the prior art showed many prepolymers and many curatives, none of which were specifically adapted to room temperature casting for the production of high-performance urethane elastomers, especially such elastomers which have remarkable low-shrink characteristics, wherein both the prepolymer and the curative are liquid or semi-liquid and stable at room temperature, and wherein the curing can also be effected at room temperature, and much less with systems which are totally free of TDI and which rely solely on MDI as the isocyanate-providing ingredient of the prepolymer.

OBJECTS OF THE INVENTION

20 It is an object of the present invention to provide liquid stable MDI prepolymers and liquid stable curative systems which are specifically adapted for room temperature casting and which yield high performance urethane elastomers upon room-temperature curing, the elastomer itself, as well as commercial combinations of

Amended Claims (Marked Form)

- 34 -

A urethane elastomer which is the reaction product of a prepolymer (P)  
which is the reaction product of

5 a) methylene diphenylisocyanate or a prepolymer of methylene di-  
phenylisocyanate and an about 500-1000 equivalent weight polytetramethylene  
ether glycol or polyoxypropylene/polyoxyethylene diol or triol having at least  
21% residual NCO,

10 b) polytetramethylene ether glycol of about 500 to 1000 equivalent  
weight, and

c) a polyoxypropylene/polyoxyethylene triol or polyoxypropylene triol of  
about 1300 to 2000 equivalent weight,

15 the percentage weight/weight in the prepolymer (P) being about 32 to  
72% of (a), about 52 to 22% of (b), and about 6 to 15% of (c), and the  
percentage of residual NCO in the prepolymer (P) being about 6 to 18% by  
weight.

which is cured at room temperature with an approximately stoichiometric  
equivalent of a liquid curative consisting essentially of the following  
components:

20 (1) a polyoxypropylene/-polyoxyethylene diol of about 1000 to 2000  
equivalent weight, (2) a polyoxypropylene/-polyoxyethylene triol of about 1300  
to 2000 equivalent weight, (3) a chain extender having an equivalent weight of  
about 25 to 125, (4) a room-temperature liquid stable prepolymer (P) having a 6  
to 18% residual NCO, (5) a diluent, (6) a degassing aid, and (7) a urethane  
25 catalyst, the relative amounts [by] weight/weight being respectively 30 - 90%,  
3 - 20%, 5 - 30%, 0 - 30%, 0 - 15%, 0.001 - 0.05%, and 0.006 [ 0.01 ] -  
0.5%.

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The urethane elastomer [cured prepolymer (P)] of Claim 34 wherein the percentage of residual NCO in the prepolymer(P) is about 11.5-13.5% [by] weight/weight and which has a room-temperature viscosity of about 550 [300] - 50000 cps, and which results in a cured urethane elastomer having the following properties after mixing and curing for seven days at room temperature:

Tensile strength (ASTM Method D-412)	about 1300-2700 psi
Elongation (ASTM Method D-412)	about 250-700%
Die C Tear (ASTM Method D-695)	about 140-400 pli
Split Tear (ASTM Method D-1938)	about 20-100 pli
Rebound (ASTM Method D-2632)	about 45-65%
Shore A Hardness (ASTM Method D-2240)	about 70-95
Gel time (25°C)	about 14-40 min..

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The urethane elastomer [cured prepolymer (P)] of Claim 35 wherein the percentage of residual NCO is about 11.5-13.5% by weight, the prepolymer (P) has a room temperature viscosity of about 3500 to 5000 cps, and the amounts of (4) and (5) in the curative are respectively 10-20 and 5-15% [by] weight/weight.

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The urethane elastomer [cured prepolymer (P)] of Claim 35 wherein the amounts of (4) and (5) in the curative are respectively 10-20 and 5-15% [by] weight/weight.



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The urethane elastomer [cured prepolymer (P)] of Claim 35 wherein the prepolymer (P) is present in an up to about 13% stoichiometric excess with respect to the curative.

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- 39 -

The urethane elastomer [cured prepolymer (P)] of Claim 38 wherein the prepolymer (P) is present in about a 2 to 7% stoichiometric excess with respect to the curative.

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The urethane elastomer [cured prepolymer (P)] of Claim 34 wherein the prepolymer (P) consists of about 54%, about 36%, and about 10% percent [by] weight/weight of the stable prepolymer (P) ingredients a), b), and c) respectively.

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The urethane elastomer [cured prepolymer (P)] of Claim 40 which is cured with an approximately stoichiometric equivalent of a curative consisting essentially of (1) a polyoxypropylene/-polyoxyethylene diol of about 1000 to 2000 equivalent weight, (2) a polyoxypropylene/-polyoxyethylene triol of about 1300 to 2000 equivalent weight, (3) a chain extender having an equivalent weight of about 25 to 125, (4) a room-temperature liquid stable prepolymer (P) having a 11.5 to 13.5% residual NCO, (5) a diluent, (6) a degassing aid, and (7) a urethane catalyst, the relative amounts [by] weight/weight being respectively approximately 54%, 13%, 10%, 15%, 8%, 0.005% and 0.006%.

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The urethane elastomer [cured prepolymer (P)] of Claim 41 wherein the curative has a viscosity at room temperature of about 3000-5000 cps and a specific gravity of about 1.05-1.08.

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The urethane elastomer [cured prepolymer (P)] of Claim 42 wherein the prepolymer (P) is present in an up to about 13% stoichiometric excess with respect to the curative.

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The urethane elastomer [cured prepolymer (P)] of Claim 43 the prepolymer (P) is present in about a 2 to 7% stoichiometric excess with respect to the curative.

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The urethane elastomer [cured prepolymer (P)] of Claim 44 wherein the properties after mixing and curing for seven days at room temperature are as follows:

Tensile strength (ASTM Method D-412) about 1550psi

Elongation (ASTM Method D-412) about 500%

Die C Tear (ASTM Method D-695) about 250 pli

Split Tear (ASTM Method D-1938) about 45 pli

Rebound (ASTM Method D-2632) about 55%

Shore A Hardness (ASTM Method D-2240) about 80

Gel time (25°C) about 20-30 min..

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The urethane elastomer [cured prepolymer (P)] of Claim 45 wherein the degassing aid is a silicone emulsion.

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The urethane elastomer [cured prepolymer (P)] of Claim 45 wherein the catalyst is a mixture of triethylene diamine and 2,3-dimethyltetrahydropyrimidine or bismuth neodecanoate.

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The urethane elastomer [cured prepolymer (P)] of Claim 45 wherein the degassing aid is a silicone emulsion and the catalyst is a mixture of triethylene diamine and 2,3-dimethyltetrahydropyrimidine or bismuth neodecanoate.

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The kit of Claim 49 wherein the percentage of residual NCO in the prepolymer(P) is about 11.5-13.5% [by] weight/weight and wherein the prepolymer (P) has a room temperature viscosity of about 3500 to 5000 cps.

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The kit of Claim 51 wherein the amounts of (4) and (5) in the separately packaged liquid curative are respectively 10-20 and 5-15% [by] weight/weight.

- 53 -

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The kit of Claim 51 wherein the separately packaged liquid curative consists essentially of the stated components in the following approximate percentages: 54%, 13%, 10%, 15%, 8%, .005%, and 0.006% weight/weight in the curative respectively and has a viscosity at room temperature of about 3000 to 5000 cps and a specific gravity of about 1.05 – 1.08.

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The kit of Claim 53 wherein the percentages [by] weight/weight of a), b), and c) in the prepolymer (P) are respectively about 54%, about 36%, and about 10%.